

Short communication

Case-study of fatal gunshot wounds from non-lethal projectiles

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Abstract

The authors present a case of the death of a 60-year-old man shot using rubber projectiles that were fired by a police officer from a Mossberg smooth-bore shotgun in an enclosed space from a distance of a few metres. The post-mortem examination revealed that death had been due to gunshot wounds in the chest which had caused heart and lung damage with subsequent massive internal haemorrhaging.

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1. Introduction

Weapons that are used for firing rubber and plastic projectiles are customarily classified as non-lethal [1,2]. These projectiles vary in calibre and can be fired from smooth-bore guns. Polish riot police are equipped with semi-automatic, pump-action 12-bore Mossberg and SDASS Imperator shotguns (Fig. 1). They are considered to be one of the legally admissible means of applying direct duress and can be employed to repulse assault and battery or to prevent the damage of property. Their most common use is for the dispersion of street demonstrations and for combat with hooligans and thugs before, during and after football matches [3–5].

The employment of plastic projectiles in smooth-bore shotguns is not considered acceptable in Poland. According to the Chief Police Commander's order no. 498 of 24 May 2004, the following cartridges can be used in conjunction with the Mossberg and Imperator shotguns:

- The special cartridge containing the Brenneke-type projectile.
- The so-called “loftka” special cartridge (containing large lead pellets of irregular shape).

- The cartridge with the Rój (Swarm), Bąk (Horsefly) or Chrabąszcz (Cockchafer) rubber projectiles (Fig. 2).
- The cartridge with the PR-PIK-94-M or PR-PIK-98 powder projectile.
- The cartridge with the immobilising CS-94-M or CS-98 powder projectile.
- The training “crash-flash” type of cartridge [4–7].

Technical data and designation of the Mossberg shotgun.

Its calibre is 12/70, weight 2.9 kg and effective firing rate five shots per 10–15 s, with a magazine capacity of five cartridges.

The Mossberg, widely known a “repeater”, is a single-barrelled shotgun with a self-loading pump-action system that can be deployed for the destruction of cover and for combat provided the distance does not exceed 50 m [8,9].

The following are the types of rubber projectile used in Poland [4]:

- The Chrabąszcz cartridge with rubber slug. The slug is a rubber cylinder with fins that stabilize its flight; its diameter is 18.8 mm and it weighs 8 g. The cartridges are manufactured in three versions, the CH-20, CH-30 and CH-50, use of which depends on the distance from which they are to be fired. The velocities attained by the slugs, as measured at a distance of 20, 30 and 50 m from the muzzle, are 116, 101 and 94 m/s, respectively. The cartridge has no plug and its wad consists of two pieces of cardboard and one piece of felt.

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Fig. 1. Mossberg smooth-bore gun ("repeater").

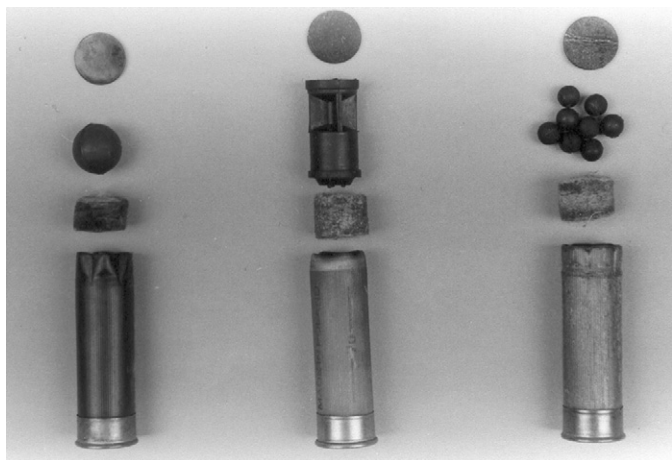


Fig. 2. Immobilizing cartridges with rubber bullets (from the left side – "Bak" / Horse-fly/"Chrabaszcz"/Cockchafer/"Rój"/Swarm).

- The Rój cartridge. It has a plastic plug and contains 15 rubber balls, each 8 mm in diameter and weighing 0.3 g. They are encased in a polyethylene sabot, which separates from the projectile after it has left the muzzle. The attained muzzle-velocity of the rubber balls is 215 m/s and the stated minimum safe distance is 20 m.
- The Bak cartridge. The projectile is a rubber ball which has a diameter of 17 mm and weight of 4.5 g. The wad consists of two pieces of cardboard and two pieces of felt. The attained muzzle-velocity is 107 m/s and the stated minimum safe distance is 20 m.

The above-mentioned rubber projectiles are universally referred to as non-penetrating and the weapons they are fired from as non-lethal weapons. Their kinetic energy has been determined such that they can hit a man without causing serious injury other than incapacitating pain, provided they are fired from the minimum safe distance. These distances are 20 m for the Bak cartridge, 20, 30 and 50 m for the Chrabaszcz CH-20, CH-30 and CH-50 cartridges, respectively, and 20 m for the Rój cartridge [4,5,10,11,12].

The kinetic energy values of the rubber projectiles at the recommended minimum safe distances are as follows: 7.3 J for the Rój projectile, 25–33 J for the Bak projectile and 30–40 J for the Chrabaszcz CH-30 projectile; their energy densities, taking into consideration the technical parameters, that is, mass and diameter, range from 11.5 to 17 J/cm². Thus, so long as the firer of the weapon follows the manufacturer's instructions,

deployment of these cartridges is considered safe and not to carry any risk of serious bodily injury.

According to the available technical data, hits from these cartridges would be likely to have the following effects. A hit from a Bak cartridge, fired at a distance of 20 m, would be painful but would inflict no serious injury, though it could cause a superficial wound commonly described as a "skin-cut". Once it had left the muzzle, a Rój projectile would create a cone-like dispersion zone. In the case of the Chrabaszcz cartridge, a hit by a projectile travelling at a velocity exceeding 65 m/s has a 50% chance of wounding exposed human skin. Generally speaking, the Bak and Chrabaszcz projectiles are similar with regard to their kinetic parameters [4,5].

2. Case description

On 28 February 1998, a police patrol was called to a flat where an intoxicated 60-year-old man ("WN") was threatening the household with an axe, in addition to demolishing furniture. Upon entering the flat, the police officers asked the offender to calm down and to put down the axe. However, the man began to approach the officers with the axe raised and ready to strike. According to their later testimonies, the initial distance between themselves and WN was approximately 5 m. One of them, equipped with a Mossberg smooth-bore shotgun, fired four times, since WN, despite having been shot, continued to move towards the officers. The shotgun deployed was loaded with five cartridges in a sequence of application from the weakest to the strongest in terms of power of impact. The man died before the arrival of the emergency services.

During the subsequent inspection of the location, four calibre-12/70 cartridge cases with detonated primers, an axe with a wooden handle, four plugs, one ball-like rubber projectile and one cone-like rubber projectile were found.

Post-mortem examination

- 10 mm above the jugular notch of the manubrium, two circular gunshot wounds with rims of abrasion were found. The tracks of the wounds penetrated shallowly into the subcutaneous adipose tissue. Inside one of the wounds, a



Fig. 3. Injuries of the chest wall.

rubber projectile measuring 6 mm in diameter was found (Fig. 3).

- A circular gunshot wound, 40 mm in diameter and with a rim of abrasion, was found in the area of the jugular notch of the manubrium. In the bottom of the wound, within the subcutaneous adipose tissue, a rubber projectile measuring 6 mm in diameter was found.
- Slightly below this, on the anterior surface of the chest, three gunshot wounds were found. Each had a diameter of 10 mm and a rim of abrasion.
- Also on the anterior surface of the chest, on the left mid-clavicular line a gunshot wound with a rim of abrasion and a diameter of 40 mm was found. The track of the wound penetrated medially and downwards, through the third intercostal space, and had damaged the medial part of the upper lobe of the left lung, the pericardial sac and the anterior wall of the left ventricle of the heart. The area of the crushed wall had a diameter of 65 mm (Fig. 4). In the left pleural cavity, there were 2 l of partially coagulated blood, as well as a rubber projectile measuring 34 mm × 14 mm and a crushed circular piece of cardboard, 19 mm in diameter (Fig. 5).
- Below the right costal arch, a circular abrasion, 34 mm in diameter, and a 60-millimetre long abrasion were found (Fig. 6).

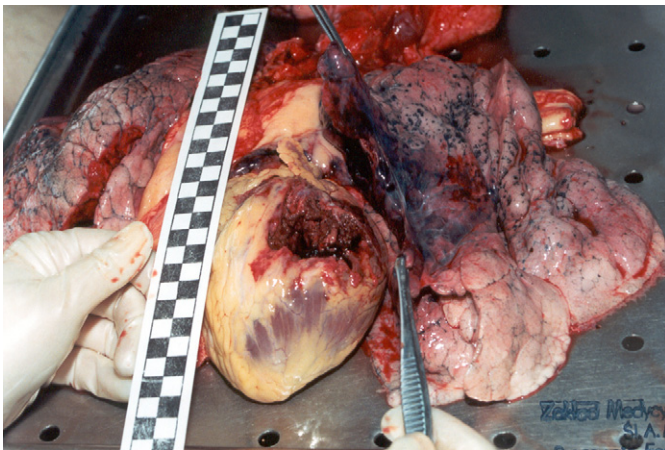


Fig. 4. Heart injuries.



Fig. 5. Rubber bullets and the wad found in the deceased.



Fig. 6. Injuries of abdominal wall.

Inspection of the man's clothes (shirt)

- In the upper part of the right sleeve of the shirt, two circular holes, with diameters of 15 mm and 5 mm, respectively, and lacerated edges, were found. Brownish-red traces resembling blood stains were also present.
- In the right side of the anterior part of the shirt, an L-shaped hole measuring 50 mm × 10 mm, with ragged edges, and a brownish-red stain were found.
- In the anterior part of the shirt, close to the left pocket, a hole with ragged edges, measuring 35 mm × 50 mm, was found.
- Below this, an irregular hole 30 mm in diameter was found, and, to its left, a large brownish-red stain.

Serological tests confirmed that the brownish-red stains which had been found were of the same blood group as the deceased's. Examination of the specimens collected from the edges of the holes did not reveal any gunpowder residues.

2.1. Expertise on ballistics

The following were examined:

- a Chrabaszcz CH-30-type rubber projectile from a special cartridge of 12/70 calibre,
- one piece of cardboard wad characteristic of a special cartridge (as well as a hunting cartridge) of calibre 12,
- two rubber pellets from a Rój cartridge of 12/70 calibre,
- a 12-bore plastic plug from a calibre-12 special cartridge.

An experiment was performed for the purpose of reconstructing the course of events and clarifying the means by which the man's fatal gunshot injuries were sustained. A dummy, the size of which was consistent with the anthropometric characteristics of the deceased, was shot several times. The shots were fired by two people, firing from both the shoulder and the hip, using a Mossberg shotgun, and the following ammunition was deployed: two Rój cartridges, two Chrabaszcz CH-20-type cartridges and two Chrabaszcz CH-30-type cartridges.

The experiment allowed of the following conclusions:

- The Mossberg shotgun which was examined was a firearm pursuant to the Arms, Ammunition and Explosives Act of 31 January 1961.
- The shotgun's mechanism worked properly and enabled the deployment of special cartridges.
- The fragments of cartridges which had been found were characteristic of such circumstances and could have been shot from the examined shotgun.
- The fatal gunshot wounds could have been inflicted by the firing of special cartridges from the examined weapon which had been aimed at the man's silhouette. The firer must have held the shotgun to his right shoulder. The wounds that were located in the lowest part of the chest could have been inflicted by the third shot, when the Chrabąszcz CH-20-type cartridge was fired.

3. Discussion

The available literature describes cases of fatal gunshot injuries resulting from the deployment of non-lethal weapons in conjunction with plastic projectiles [11,13–18]. A comparison of the localisation and severity of the injuries sustained by the victims, who were shot with rubber and plastic cartridges, revealed that the latter less frequently hit the head and chest than their rubber counterparts. This accuracy can be ascribed to their following a more stable trajectory and their tendency to hit targets with their front surface. Fatal cases described by Rock, Ritchie and Gibbons, Chute Smialek and Yellin were the results of gunshots to the head and chest using plastic projectiles [14,17,18]. According to Rock, plastic projectiles cause more severe head injuries than rubber ones [18]. During the *Intifada* in Gaza, Judea and Samaria, 20 cases of fatal gunshots using plastic and rubber projectiles were reported. The projectiles deployed by the Israeli forces were, however, covered with a 2-millimetre thick layer of metal. The risk of causing fatal bodily injury through the use of such plastic and rubber projectiles during these events was calculated as 1:16000–1:18000 and 1:4000, respectively [13,15,19–21].

Impact projectiles containing rubber rounds, that are deployed whilst taking due regard to the minimum safe distance (which depends on the type of projectile), and which are aimed at the lower parts of the body, are considered to be fairly safe. The risk of sustaining serious, life-threatening or fatal injury is inversely proportional to the distance between the firer and the target, and increases significantly if a round hits the upper parts of the body, that is, above the diaphragm. The available literature, namely, Bir's study, confirms that shots aimed at the front wall of the trunk and fired at a distance of less than 5 m carry a significant risk of inflicting serious or even fatal injury. The energy-densities of the Rój, Bąk and Chrabąszcz projectiles, when fired from a short distance, are high enough for them to injure not only the skin, but also underlying internal organs. Bir's experiment showed that the area between two ribs is the region with the lowest threshold value for skin-penetration [16,22–25]. Moreover, the calculated

energy densities positively correlate with the value determined by the manufacturer of the Chrabąszcz CH-30 projectile and correspond well with the deceased's injuries. It should be emphasized that the technical parameters of the projectile which was extracted from the pleural cavity are comparable with the characteristics of the ammunition used by Bir et al. The significance of the above findings is reinforced by the results of the retrospective analysis of injuries caused by rubber bullets during the Arab–Israeli conflict of 2000, which showed that most of the serious chest injuries leading to pneumothorax, haemothorax, pericardial tamponade and the like, were inflicted by the rubber bullets penetrating the chest wall in between the ribs [9].

Ballistic studies show that, for shots fired from a distance not exceeding 5 m, projectiles and their wads maintain the same trajectory. In cases in which a projectile and other parts of the cartridge, such as a wad or a plug, are found within the track of the wound, this finding can be extremely helpful for both the post-factum determination of the firing distance and the reconstruction of the event [7].

On the basis of the results of the whole investigation, including the ballistic studies and the procedural experiment performed, it may be concluded that the police officer had not abused his authority in deploying his weapon against the armed aggressor, and that taking shots at the chest had been justified by the course of the event, its violence, the man's aggressive behaviour and the life-threatening situation thus created.

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